Docket No. F-8223

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Masaharu MIYAHISA, et al.
Serial No.	:	10/823,863
Filed	:	April 14, 2004
For	:	METHOD AND APPARATUS FOR MANUFACTURING BATTERY ELECTRODE PLATE AND BATTERY USING THE SAME
Group Art Unit	:	1745
Examiner	:	Mark Ruthkosky
Confirmation No.	:	6189
Customer No.	:	000028107

Certificate of Mailing Under 37 CFR 1.8

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Herbert F. Ruschmann (Name)

(Signature)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER 37 C.F.R § 1.132

I, Masahura MIYAHISA, declare and say:

That I am a citizen of Japan and I reside at 4-5-18, Kugenumahinmei, Fujisawa-shi, Kanagawa 251-0021, Japan.

That I am one of the coinventors in the above-identified patent application.

That I graduated from and earned an engineering degree from Oita National College of Technology, Department of Mechanical Engineering.

I have been working in the field of engineering for 31 years and presently hold the position of Senior Manager with Matsushita Electric Industries Co. Ltd the assignee of the above-identified patent application.

I am familiar with the above-identified patent application and the following references cited in the rejections of the claims.

That tests were made on specimens prepared in accordance with procedures disclosed in the Mikiaki reference (JP 2000-077054) and the Hideo reference (JP 62-136759) and that the results of the tests are presented in Tables I and II, and Declaration Figs. 1-3 included in this declaration.

I. THE PRESENT INVENTION COMPARED TO THE HIDEO REFERENCE.

That the test results presented in Table I are based on specimens prepared in accordance with the process disclosed in the Hideo reference and the process of the claimed invention.

Table I

	The prior art Hideo reference (without a binder) (brushing and blowing)	The present invention (without a binder) (ultrasonic vibrations)
Residue left in rail (%)	4.83 (mean value) 4.37 - 5.53	3.27 (mean value) 2.5 - 3.7

That the specimens were impregnated with active material without a binder as use of a binder was not practiced at the time of the Hideo reference and is not disclosed in Hideo reference.

That, in accordance with the Hideo process disclosed in the text and the figures of the reference, the following procedures were done to prepare the specimen according to the Hideo reference:

1. As shown in Fig. 1(A), expandable metal was filled with active material without a binder.
2. As shown in Fig. 2(B), a pressed portion 1 was formed leaving a linear projected part 4.
3. The active material in the projected part 4 was removed by brushing and blowing.
4. As shown in Fig. 2(C), the projected part was then pressed.
5. Removing the active material in the projected part 4 to determine residue left.

That in accordance with the present invention as claimed the following procedures were done:

1. Impregnating an entire porous core substrate, which forms the at least one battery electrode plate and is shaped like a thin plate, with an active material.
2. Press working a first surface of said active material impregnated core substrate to form a rail shaped protrusion protruding above pressed portions and defining boundaries with said pressed portions.

3. Removing the active material from a volume of said active material impregnated core substrate defined by said rail shaped protrusion and extending from said first surface at said rail shaped protrusion to an opposing second surface of said active material impregnated core substrate to form said rail shaped protrusion into a core substrate exposed section by applying ultrasonic vibrations to said rail shaped protrusion.
4. Compressing said core substrate exposed section to result in a strength of said core substrate exposed section after said removing of said active material and said compressing being substantially equal to a strength of said pressed portions; and
5. Cutting said core substrate exposed section after said compressing to form said battery electrode plate with a current collector having an edge formed by the cutting of said core substrate exposed section.
6. Removing the active material in the projected 4 to determine residue left.

That residue left in rail, i.e., the projected part 4 and the core substrate exposed section (hereinafter referred to as collector), was obtained by immersing an aqueous solution of acetic acid, which dissolves only the active material, and calculating the weight of residual active material within the rail section was based on the rate of change in the weight of the dissolved active material.

That the test results shown in Table I indicate that, contrary to a literal interpretation of the assertion in the Hideo reference that no active material is in the projected part 4, active material does remain.

That Declaration Fig. 2 presents photographs and an illustration of one of the specimens specimen prepared according to the claimed invention wherein the active material did not include a binder.

I(a). Residue Comparison.

That the test results show that the process of the Hideo reference leaves more residue than the process of the claimed invention.

That the tests results show that the present invention produces a residue level mean of 3.27% which is markedly better than the 4.83% produced by the Hideo method.

II. THE PRESENT INVENTION COMPARED TO THE MIKIAKI REFERENCE.

The Mikiaki reference was developed at Matsushita Electric Industries Co. Ltd. as was the present invention.

That the test results presented in Table II are based on specimens prepared in accordance with the process disclosed in the Mikiaki reference and the process of the claimed invention.

Table II

	The prior art Mikiaki reference (without a binder) (brushing and blowing)	The present invention (includes a binder) (ultrasonic vibrations)
Residue left in rail (%)	5.75 (5.08 - 6.4)	4.29 (3.97- 4.6)
Warping of rail (mm)	0.38 (0.2 - 0.56)	0.14 (0.08 - 4.6)
Strength of rail (Kg)	5.6 (4.9 - 6.25)	5.65 (5.07 - 6.2)
Straightness of boundary (mm)	About * 0.6	0.11 (0.08 - 0.15)

* the boundary between the core substrate exposed section and the pressed portions is obscure.

II (a). The Mikiaki Reference.

That, in accordance with the Mikiaki process disclosed in the text and the figures of the reference, the following procedures were done:

1. As shown in Fig. 17 portions of a core substrate formed of an expandable metal foam were pressed to formed a plurality of slots.
2. The expandable foam metal was filled with active material without a binder.

3. The core substrate was then pressed.
4. The core substrate was then cut to obtain a plurality of electrode plates.
5. The active material in the slots was then removed using brushing and an air blowing in order to form core substrate exposed portions.

That specimens were prepared in accordance with the present invention as detailed above and a binder was included in the active material, and that Table II includes data obtained from these specimens and Declaration Fig. 3 presents photographs and an illustration of one of said specimens of the present invention.

That the binder reduces the dislodgement of active material from the claimed press portions thereby preventing shorting in the battery.

That the binder makes removal of the active material from the collector portion more difficult than in its absence and that despite this increased difficulty the present invention method clearly achieved better residue results than the Mikiaki method applied to a substrate lacking a binder.

That for the specimen produced by the method of the Mikiaki reference shown in Declaration Fig. 1, the following observations were made:

1. A separation boundary of the impregnated portion of the pressed portion and the exposed portion extends into the pressed portion resulting in variation of impregnation in the pressed portion.
2. The separation boundary is unclear.
3. The residue of the active substance remaining in the exposed core collector lead portion was 5.53%.

II (b). The Present Invention Without Binder

That a specimen produced by the method of the present invention without a binder is shown in Declaration Fig. 2, and that the ultrasonic vibrations were applied with an amplitude of 27 μm, a horn gap of 0.9 mm, and a speed of 150 mm/s.

That in regard to the specimen shown in Declaration Fig. 2, the following observations were made:

1. The separation boundary of the impregnated portion of the pressed portion and the exposed portion exhibits a slight variation which is visibly less than that of the boundary in Declaration Fig. 1 and is substantially straight.
2. Variations in the pressed portion is less than in Declaration Fig. 1.
3. The residue of the active substance remaining in the exposed core collector lead portion was 3.47%.

II (c). The Present Invention With Binder.

That a specimen produced by the method of the present invention without a binder is shown in Declaration Fig. 3, and that the ultrasonic vibrations were applied with an amplitude of 27 μm, a horn gap of 0.9 mm, and a speed of 150 mm/s.

That in regard to the specimen shown in Declaration Fig. 3, the following observations were made:

1. The separation boundary of the impregnated portion of the pressed portion and the exposed portion lies on the R0.4 line, exhibits negligible variation which is clearly less than that of the boundary in Declaration Fig. 1, and is essentially straight.
2. Variations in the pressed portion cannot be observed in contrast to the clearly evident variations in Declaration Fig. 1.
3. The residue of the active substance remaining in the exposed core collector lead portion was 3.47%.

II(d). Residue - Mikiaki vs. The Present Invention.

That the test results in Table II show a significant improvement in the amount of residue left when the process of the present invention is used compared to when the brushing and blowing method of the Mikiaki method is used. The Mikiaki process resulted in a residue level of 5.75 % when no binder was used in the active material, while the present invention resulted in a boundary variation of about 4.29% even with binder included in the active material. This 4.29% is a within rounding to the claimed 4% and is produced by test data which ranges from less than 4% and above. Still further, the residue test data for the Mikiaki reference ranged from 5.08 % to 6.4% which is above the 4% range.

II(e). Boundary Straightness- Mikiaki vs. The Present Invention.

That the test results in Table II show a nearly 6 times improvement in boundary straightness when the process of the present invention is used compared

to the straightness achieved by the brushing and blowing method of the Mikiaki method. The Mikiaki process resulted in a boundary that varied by about 0.6 mm while the present invention resulted in a boundary variation of about 0.11 mm.

II(f). Impregnated Active Material Density Variation -
Mikiaki vs. The Present Invention.

That the Mikiaki method impregnates the core substrate after the formation of the slots and this results in a variations of in the density of the impregnated active material which exceed the of the 1.5% produced by the claimed process of the present invention. The this variation in distribution is due to the accumulation of the active material, which is applied in liquid form, in areas bordered by slot edges when the active material is applied.

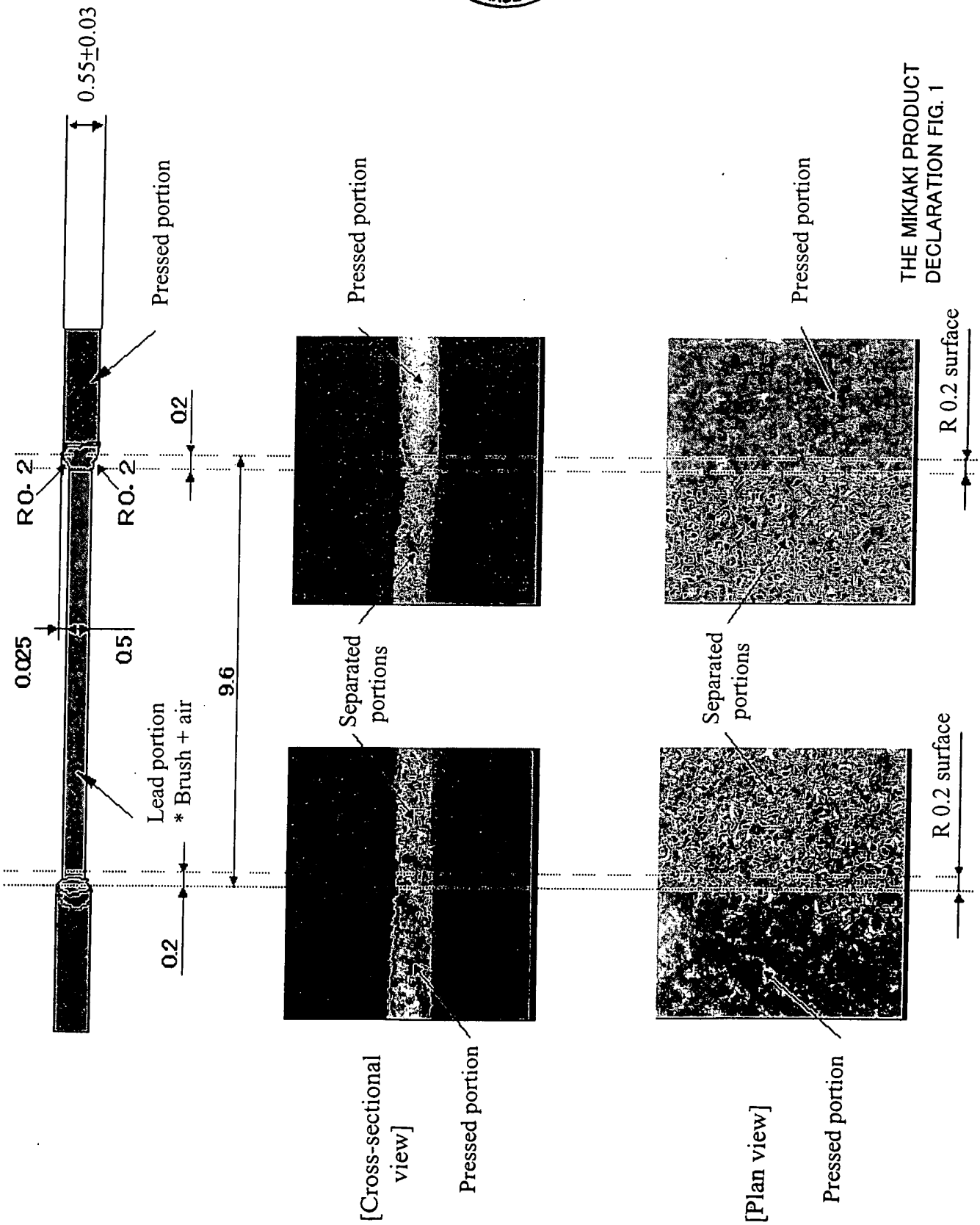
III. Declaration Statement.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

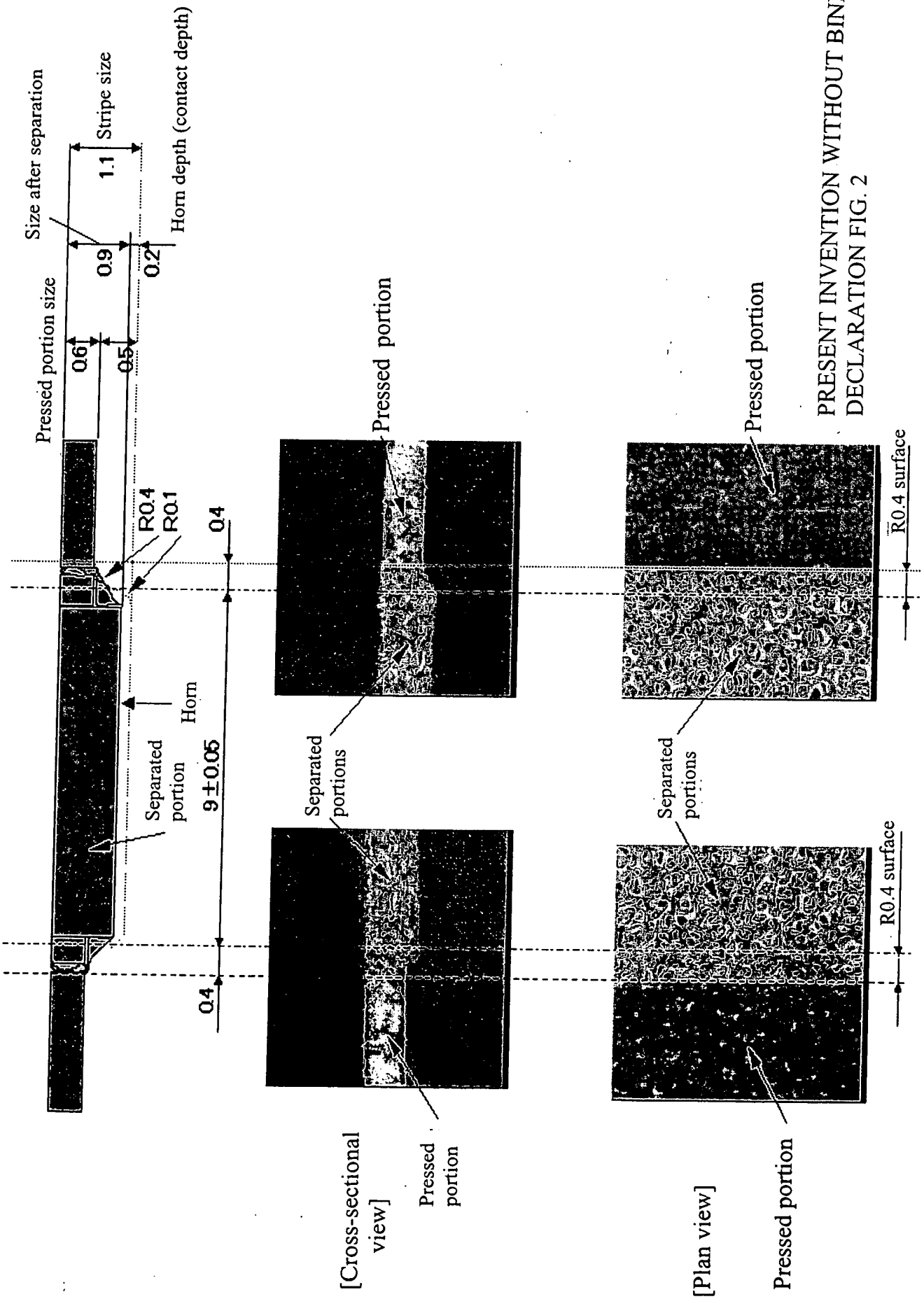
By_____

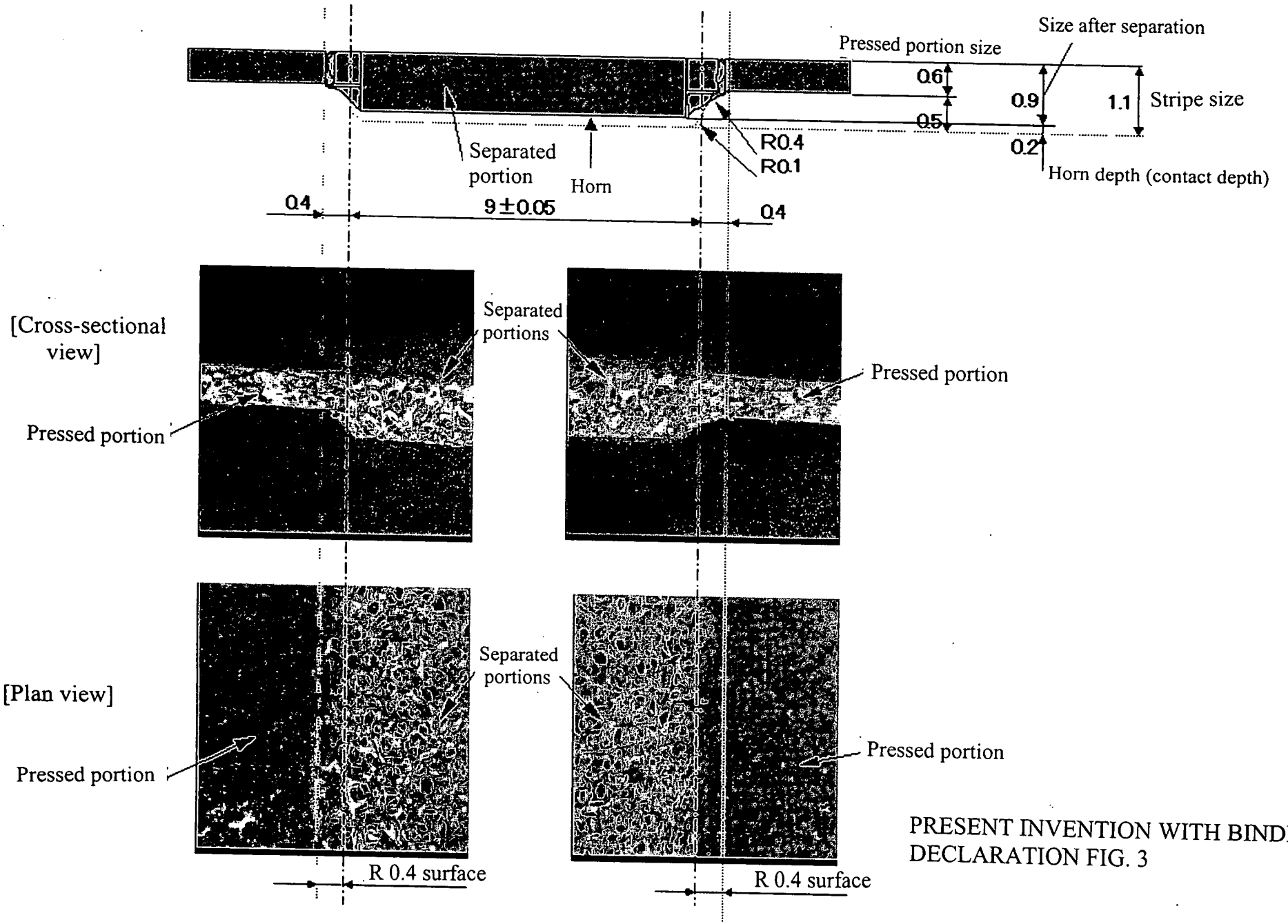
Masahura MIYAHISA

THE MIKIAKI PRODUCT
DECLARATION FIG. 1



PRESENT INVENTION WITHOUT BINDER
DECLARATION FIG. 2





PRESENT INVENTION WITH BINDER
DECLARATION FIG. 3